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The level of individual participation of community in implementing effective solid waste management policies

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ABSTRACT

It is crucial to achieve effective solid waste management involving not only formal/government agencies, but also individual/informal/voluntary actions in order to create a healthy environment. This study conducted to unveil the factors that increase individuals' community participation in solid waste management policy. The data were matched with a literature review on existing waste policies to identify gaps in knowledge, which could provide beneficial policy recommendations for the Jakarta Provincial Government. The ordinary least squares regression and Indonesian family life survey data were used. The respondents' waste handling and participation scores with potentially affected variables were calculated and regressed. Out of 1.791 respondents, the regression revealed that the participation of individuals from Jakarta is influenced by 1) the frequency of their involvement in social community activities, 2) their education level, and 3) per capita expenditure. The solid waste management score increased by 0.233 if the respondents were more socially active, with a participation score of 1. Empowerment had a 0.06 coefficient correlation relative to the waste handling score. According to the broader sample of 28.967 respondents from large cities in Indonesia. It was concluded that individuals' participation could be enhanced by hosting various social activities at the grassroots level. The study's gaps show that the Jakarta Provincial Government has a high propensity towards increasing individuals' participation in solid waste management by maximizing control of the factors mentioned above (especially empowerment), as well as by raising the frequency of citizens' involvement in social community activities at the grassroots level.

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INTRODUCTION

Indonesia not only the largest archipelagic state, it is also the fourth most populous country in the world. As a result of economic and population growth, the country is currently facing two fundamental environmental problems: 1) difficulty managing waste collection and 2) rapid waste accumulation (Marchal *et al*., 2019). However, it is also suffering from non-renewable energy use. In this study, the potential ways for the government to simultaneously address these two environmental challenges were explored. Alternative solutions include using technology that can turn waste into an energy supply source. Indonesia is one of the fastest-growing (and largest) energy users of the Association of Southeast Asian Nations (ASEAN). According to IRENA, (2017), Indonesia's activities account for up to 40 percent (%) of total energy use. This number is expected to more than triple by 2030. Yet most of Indonesia's energy consumption comes from non-renewable energy resources (such as fossil-based fuels). Local oil and gas production is unable to meet rapidly rising energy demands (Tharakan, 2015). Since 2004, Indonesia has been a net oil importer. Consequently, the adoption of sustainable and renewable energy technologies (such as the application of biogas from animal waste) has become critical to Indonesia's development of an energy sovereignty strategy. According to the International Energy Agency (IEA, 2015), as of 2012, most of Indonesia's national energy supply has come from oil; only a small portion is grounded in new and renewable energy sources. Although it has excellent potential, Indonesia only exploits around 5% of its overall capacity for renewable energy. Using renewable energy lowers the risk of environmental damage, such as water and air pollution, damaged wildlife habitats, reduced land use, and global warming emissions. Solid waste management (SWM) is vital to pursue because almost all economic sectors produce solid waste (SW). Factors that cause environmental concern are based on human reasoning and behaviour. Citizens' active participation is crucial to identifying issues in waste management. Efforts to preserve the environment must begin at the individual level by starting small transformation. Changes can then become habits in the family or community, resulting in significant shifts in the way people think about household waste management to mitigate waste at the source through citizen participation (Ruliana *et al*., 2019). Economic expansion contributes to an increase in the gross domestic product (GDP). In addition to economic development, other components that influence the amount of SW are population expansion, education, employment, and consumption patterns. With high GDP growth, Indonesia produces a high degree of SW. Meanwhile, the average urban waste management service has not operated optimally (Lestari and Trihadiningrum, 2019). The primary purpose of this research is to use responses to the Indonesian Family Life Survey (IFLS) to determine factors affecting individuals' participation in SW handling in the urban environment. The survey pinpoints current practices for the disposal of household waste in Jakarta. There is an absence of specific policies dedicated to managing inorganic and hazardous household waste. Accordingly, the existing relevant policies, conditions, and current SWM problems in developing Asian countries were reviewed. The aim was to find alternative solutions to reduce waste. Developing countries were classified as low-income (with a gross national income [GNI] of $1.005 or less), lower-middle-income (GNI of $1.006 - $3.975), upper-middle-income (GNI of $3.976 - $12.275) and high-income (GNI of $12.276 or more). Some developing nations in Asia (such as Sri Lanka, India, Bangladesh, Pakistan, Afghanistan, Thailand, Malaysia, Indonesia, Vietnam, Iran and Nepal) are in the range of low to lower-middle income (Dhokhikah and Trihadiningrum, 2012). In this study, it was measured and analysed how certain variables affect individuals' participation in SWM and handling activities. The study was carried out in Jakarta and other large Indonesian cities in 2019 based on 2014 survey data in order to solve Jakarta's severe SWM problem, as well as to support the local government's policy for handling waste. To address ineffective policies, the study has offered another perspective on what is possible, identifying elements among citizens that lend considerable support to creating a better environment.

MATERIALS AND METHODS

Ideological framework

In this study, SWM at the individual level refers to informal/voluntary activities (as the government does not undertake them) (Ezeah *et al*., 2013). People and/or enterprises(s) willingly collect waste to build a healthy environment. Even though the informal waste

collection is not immediately useful, it is believed that casual waste collection is helpful in terms of promoting environmental awareness (Jerie and Tevera, 2014). The informal activities of waste management systems in developing countries are expected to help fill the gap caused by local governments' inefficiency in this area (Gunsilius and Chaturvedi, 2011). Yoada *et al.* (2014) carried out a mixed-methods, cross-sectional survey, and in-depth interviews to measure domestic waste handling and disposal. The longitudinal data were used (cross-sectional changes over time) to gauge urban residents' behaviour relative to their social activities.

Table 1 illustrates the predicted amount of waste in 15 major Indonesian cities. The population data refer to data from BPS (Indonesia's National Bureau of Statistics). The waste generated is estimated to be 0.87 kilograms per person per day (kg/capita/day). Meanwhile, the data on waste handled through FDS are provided by DKPP (Jakarta's Cleaning, Parks, and Cemeteries Department), excluding third-party waste collectors' data. As shown in Tier 1, the largest city is Jakarta. However, Surabaya has the most unhandled waste. Approximately 40.48% of Surabaya's waste is unhandled, while only 26.02% of Jakarta's is. Tier 1 further indicates that Makassar has the least amount of unhandled waste (7.70%), even though its population is 1.449.401 (significantly higher than that of Bitung and Balikpapan). In Tier 2, Padang has the most unhandled waste (52.18%). However, the biggest city is Medan. In the last group of towns, Mataram has the most unhandled waste (41.13%); it is the least populous city in the group (Shuker and Cadman, 2018). Thus, from Table 1, it can be concluded that high populations do not necessarily affect the overall amount of unhandled waste. As mentioned earlier, Indonesia is facing two fundamental environmental problems: non-renewable energy use and waste accumulation. These two issues endanger the environment (Khalil *et al.*, 2019). However, there is a way for the government to address both problems at once. The solution is to use technology, which can

Table 1: Estimated waste generation from 15 large cities in Indonesia (Shuker and Cadman, 2018)

City	Population	Estimated waste generated (tons/day)	Waste handled through Final Disposal Site (FDS)	Unhandled waste	Estimated % of unhandled waste
Tier 1					
Balikpapan	615.574	535.6	375.7	159.9	29.85%
Bitung	205.675	178.9	133.1	45.8	25.60%
Surabaya	2.853.661	2482.7	1477.7	1005.0	40.48%
Makassar	1.449.401	1261	1163.9	97.1	7.70%
Jakarta	10.075.310	8765.5	6484.7	2280.8	26.02%
					Tier 2
Denpasar	880.600	766.1	638.5	127.6	16.66%
Padang	902.413	785.1	375.4	409.7	52.18%
Manado	425.634	370.3	326.6	43.7	11.80%
Medan	2.210.624	1923.2	1564.7	358.5	18.64%
					Others
Pontianak	607.438	528.5	371.5	157.0	29.71%
Semarang	1.595.267	1387.9	1087.2	300.7	21.67%
Yogyakarta	412.704	359.1	267.2	91.9	25.59%
Batam	1.037.187	902.4	798	104.4	11.57%
Mataram	450.226	391.7	230.6	161.1	41.13%
Bandar Lampung	979.287	852	789.1	62.9	7.38%

turn waste into a n energy supply source.

Fig. 1 shows that central Jakarta is the area of the city with the most significant amount of waste, including paper, plastic, and metal. Central Jakarta is one of six major parts of the Special Capital District of Jakarta (DKI Jakarta) Province, which has the smallest landmass. In contrast, south Jakarta produces the least amount of waste. This implies that a large land area does not necessarily result in a high amount of garbage being collected. Free waste collection is carried out in zones where officials do not provide waste management or sanitation services, especially in developing regions and/or states. In some cases, recyclable waste materials are recovered from collected waste; third parties then trade them and either reuse or recycle them in the conventional waste management system. Such informal activities occur in places where recyclable material waste accumulates (such as streets, green fields, lakes and rivers, landfills, etc.). Gathering these objects can be a part-time or full-time occupation (Ferronato and Torretta, 2019). In this study, the informal waste collection at the individual level was measured. It is believed that significant participation from individuals influences their involvement in the casual waste collection (or informal SWM) concerning social activities. Hence, if an individual frequently takes part in necessary social activities (daily interactions, pure teamwork, etc.), he/she is more likely to engage in the secure handling of SW in his/her environment. These informal activities are useful for handling SW on a relatively small scale (Burcea, 2015). Thus, such participation to determine SWM activities was used that was accessible to individuals. In other words, those who are generally prone to community participation are more likely to participate in informal SWM activities, versus those who are usually uninvolved (Sinthumule and Mkumbuzi, 2019). Low engagement is assumed to be due to differences in the level of acceptance of information about waste separation, environmental knowledge, and ecological attitudes among residents. Other conditions may also influence community participation (Ruliana *et al*., 2019). Transforming paradigms surrounding SWM requires involvement from multiple stakeholders. One crucial issue is altering behaviour toward waste. As the reduce-reuse-recycle (the three Rs) became a vital aspect of SWM, it became necessary to examine changes in the knowledge and practice of waste source agents (Halimatussadiah *et al*., 2017). In the

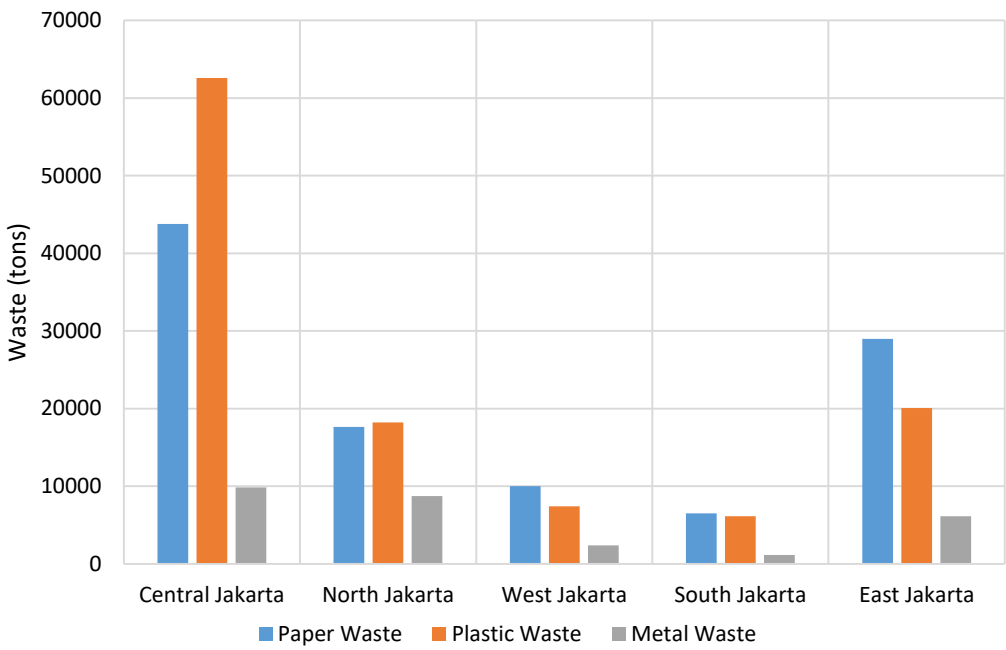

Fig. 1: Amount of solid waste generated by type and region

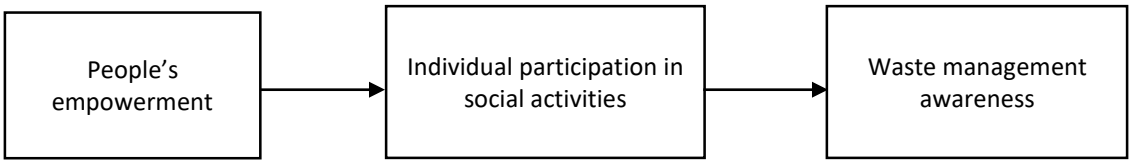

Fig. 2: Framework of the current study

following paragraphs, the determinants of individual participation were discussed and how to best measure them. A common approach was employed to determine how individuals overcome waste problems in their environments. Individuals' awareness of maintaining a healthy environment is influenced by the empowerment they possess or receive from external sources. Critical components in any waste management program include public awareness and participation, in addition to appropriate legislation, strong technical support, and adequate funding. Waste results from human activity and everyone needs to have a proper understanding of waste management issues (Marshall and Farahbakhsh, 2013). Empowerment can be gauged through education, expenditure, and one's involvement in neighbourhood social activities. Further, individual awareness of healthy, clean habits begins at the community level. Community empowerment encourages individuals to engage in positive practices, leading to environmental awareness (Holmberg *et al*., 2018). That is to say; individuals begin to care about waste and keeping the environment clean as part of communal efforts. The research framework is outlined in Fig. 2.

As shown in Fig. 2, people's empowerment affects individual participation in social activities, which can trigger a community's awareness of waste management. The empowerment referred to in Fig. 2 can take the form of an intervention from an external party. Such participation is intended to increase community engagement in neighbourhood social activities. IFLS data have been used to establish individual awareness and participation. Individually, individuals' responses and contributions to garbage-related neighbourhood activities will be analysed through scoring. Using this framework, personal awareness of (and participation in) such activities is hypothetically affected by 1) the respondent's involvement in general social activities and 2) the number of events held in the neighbourhood.

Economic modelling and data

Individual participation in informal SWM is categorized into contributing 1) time, 2) money, and 3) direct efforts (Gunsilius and Chaturvedi, 2011). According to Burcea (2015), such contributions are hierarchical, while Asim and Batool (2012) found them to be equal. After reviewing this debate, the contributions may be hierarchical because decision-making in Indonesia has a top-down hierarchy; furthermore, cultural factors also play a role in this process. In the model, each contribution type is worth a different number of points. Individual contribution scores (hereafter, 'garbage scores') were tallied based on participation in informal SWM activities (as identified in the IFLS) (Kumar *et al.*, 2017). The IFLS asks what kinds of contributions individuals made towards SWM activities. Survey respondents' contributions were indicated using essential checklists. Likewise, a simple scoring system was used. The IFLS data employed were from Wave 5, conducted in 2014 (Strauss *et al*., 2016). This dataset was used for analysis due to its high quality (relative to other data) for capturing individual participation in waste handling activities. The level of observation was unique, with samples of more than 25.000 respondents and 30.000 households. Individual scores for social involvement and waste management also determined contribution types. For this study, the individual contributions were divided into three levels: 1) energy and time, 2) monetary, and 3) other material contributions (from the highest to the lowest, respectively). For each type of social activity, individuals' contribution scores ranged from a minimum of 0 to a maximum of 6. Energy and time contributions were worth 3 points, while monetary and other material contributions were worth 2 and 1 points, respectively. There are various combinations of contribution levels, as each individual is capable

of making more than one type. Hence, the maximum contribution score (for those who took part in all social activities) was 6 and the lowest was 0 (for those who did not participate in any). Moreover, individual participation was not measured using just one kind of social activity (Ni'mah *et al.,* 2018). Several types of events were used that relate to clean lifestyles. (Note that all social events from the IFLS were not used) The activities included are local meetings, neighbourhood clean-ups, village rehabilitation, youth group activities, religious activities, health funds, water and sanitation activities, SWM, and family financial management.

Variable determination

This study is about SWM and composition influenced by other socioeconomic factors, including average family size, the number of room(s) in a household, monthly income, and employment status. A direct relationship was identified between stable waste composition and social activities in the community. Other factors, including changes in the source-sorting behaviour and the consumption of goods, affect the structure of SW and its quantity in households. It was recognized that determinants influencing individual participation consist of socioeconomic, economic, and geographic elements. In this study, the socioeconomic aspects were established through age, one's involvement in social activities, education level, marital status, and religiosity. The economic components were determined through per capita expenditure (PCE), while geographical determinants were assessed through dummy variables for all regions (Jakarta and non-Jakarta). The dependent variable in this research was the 'garbage score', which shows the rate of individual participation in neighbourhood garbage-related activities (e.g., neighbourhood clean-ups, handling SW, etc.). This variable approximates single enrolment in local social events held to manage home waste. The garbage scores ranged from 0 (no involvement) to 10 (full responsibility). Respondents' enrolment can be measured in terms of financial contributions, time contributions, direct participation, or all of the above. The first primary independent variable in this research is an individual's participation score for each social activity held in the neighbourhood. The individual participation score is based on respondents' enrolment in nine previous social events. The next variable of interest is 'empowerment' or the number of social events held in the neighbourhood. These independent variables include education level, age, sex (dummy variable: 1 for male, 0 for female), PCE, and religiosity. The religiosity scores ranged from 0 (not religious) to 4 (very religious). The following are the basic models of estimation.

$$Garbagescore = \beta_0 + \beta_1\, Indv_Partiscore + \beta_2\, Empowerment + \beta_3\, EDUC + \beta_4\, PCE + \beta_5\, Religiosity + \beta_6\, Age + \beta_7\, Sex_i \quad (1)$$

$Garbagescore$ represents an individual's participation in garbage-related activities (e.g. neighbourhood cleaning, handling SW), and higher scores indicate more significant contributions to SW handling. β_0 is a constant parameter. $\beta_1,\ldots\beta_2$ is a parameter of each independent variable. The Individual participation score signifies individual participation in each social activity held in the respondent's neighbourhood. Empowerment is the number of social activities held in the respondent's neighbourhood over the past week. EDUC is the respondent's education level, measured in years of schooling. The PCE is in rupiahs. Religiosity is the self-reported, subjective level of religiosity. Age is the respondent's age. Sex-i is a dummy variable for the respondent's sex (male or female). The ordinary least squares (OLS) regression were used to analyse the impact of education level, PCE, the individual participation score, and the number of social activities related to the clean lifestyle score using Stata MP 14, a statistical software suitable for managing, examining, and plotting quantitative data, enabling a variety of analyses to be performed. The program is also appropriate for processing time series, panel, and cross-sectional data.

RESULTS AND DISCUSSION

Results and analysis

For a deeper understanding of SWM in Jakarta, the regression results were compared across two different groups: all cities included in the IFLS survey (including Jakarta), and Jakarta only. The overall outcomes of the first and second estimation (Est) assess SWM in general. The third and fourth estimations look at SWM in Jakarta alone. Below are

the regression findings of the waste management awareness score.

Table 2 explains the relationship between individual participation in community activities, years of schooling, PCE, religiosity, and high personal involvement in SW disposal. Table 2 shows an increase of 1 point in its participation, which raises the garbage score (waste handling score) to 0.178 (estimation 1). An increase of 1 year of schooling increases this score by 0.008. An increase of 1 million rupiahs in PCE decreases the score by 0.0178. An additional level of religiosity by 1 tends to decrease the score by 0.07. Older people tend to have a lower rating, while males usually dominate waste handling activities. Table 2 demonstrates that these four factors are positively related to individuals' high involvement in SW disposal. From the estimates above, it can be concluded that individual awareness and participation in waste-related activities are significantly affected by own participation (in other general social events), years of schooling, PCE, and religiosity. Individual participation positively affects garbage scores; the relationship is also significant. This means that respondents who are active in other social projects are far likelier to participate in and contribute to waste-related actions (like neighbourhood clean-ups and SW handling) (Yoada *et al*., 2014; Zakianis *et al*., 2018). This confirmed the hypothesis that individuals' enthusiasm for and participation in neighbourhood social activities would raise their garbage scores. Social empowerment is significantly and positively tied to garbage scores. This signals that the number of social activities held in a community increases individual participation in waste management (McAllister, 2015). The estimate above does not show a reciprocal relationship between empowerment and individual participation scores. However, community empowerment has significant effects on garbage scores. Years of schooling generally has a positive, meaningful impact on respondents' garbage scores; in other words, more years of higher education leads to higher garbage scores (White, 2013). This means that more educated people have a higher awareness of environmental care. Hence, education level matters for community well-being. Highly educated people have more excellent participation rates in social activities. Accordingly, they also offer greater contributions to well-being at the neighbourhood level. In the case of Jakarta, years of schooling harms respondents' SWM activities (Stingl, 2018). This

Table 2: Regression results of the waste management awareness score

	24 Cities in Indonesia		Jakarta Only	
	Est 1	Est 2	Est 3	Est 4
VARIABLES	Garbage score	Garbage score	Garbage score	Garbage score
Individual score of participation	0.178***	0.164***	0.273***	0.233***
	(0.0016)	(0.0016)	(0.0074)	(0.0075)
Empowerment	0.0543***	0.0831***	-0.00253	0.0661***
	(0.0048)	(0.0048)	(0.0214)	(0.0201)
Years of schooling	0.00814***	0.000977	-0.0105	-0.0192*
	(0.0022)	(0.0022)	(0.0107)	(0.0101)
Per capita expenditure	1.78e-08**	1.45e-08*	-1.04E-08	-2.57E-08
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Religiosity	-0.0752***	-0.0248**	-0.128***	-0.0273
	(0.0107)	(0.0106)	(0.0460)	(0.0440)
Age		-0.00406***		-0.000158
		(0.0005)		(0.0024)
Sex		0.561***		1.153***
		(0.0149)		(0.0656)
Constant	-0.0603	-0.279***	0.666***	-0.139
	(0.0413)	(0.0462)	(0.1870)	(0.1960)
Observations	28.967	28.967	1.791	1.791
R-squared	0.396	0.425	0.485	0.561

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

finding suggests some unenlightened behaviour, as the more educated people should have a higher awareness of SWM. The negative correlation, in this case, implies that more educated people are less involved in SWM activities. However, this negative relationship might not point to actual conditions, since it is not statistically significant at the 5% level (Hynes *et al*., 2018). PCE has a positive, meaningful connection to garbage scores; it has been used as a proxy for respondents' economic status. This relationship means that respondents' awareness of environmental care rises along with their financial situation. More affluent people tend to make more significant contributions and have higher knowledge. This estimate also supposes that wealthy zones are much cleaner compared to weak areas. In Jakarta, however, wealth has a negative, insignificant impact on SWM activities. Again, this outcome suggests incomprehension among citizens, although it is statistically insignificant (i.e., not robust). This relationship highlights the need for further research. In the second and fourth estimations, age has a negative correlation with garbage scores. The older the respondents are, the less they participate in SWM activities (Joshi and Ahmed, 2016). In these estimations, sex has a positive impact on individuals' participation in these activities. Specifically, males tend to contribute more than females (especially in Jakarta). The unique variable in this research is religiosity. In the estimates, religiosity has a negative, significant impact on garbage scores. This phenomenon is quite odd, as Indonesia is home to the world's largest Muslim population, and Islam teaches its believers that being 'clean is half of faith'. Moreover, Islam venerates environmental well-being. Other religions in Indonesia also uphold environmental well-being as a value common among believers. However, the estimate reveals the opposite. Based on the estimation, higher religiosity should be followed by lower garbage scores. In practice, though, the higher the religiosity, the higher the garbage score. It is therefore conducted a summarizing test based on the groups. After the summarizing analysis, it was found that in Indonesia, those with little education also have high levels of religiosity. The table below depicts the average garbage score based on religiosity and years of schooling.

Table 3 demonstrates that a higher religiosity level is not followed by a higher mean number of years of schooling (education level). The most religious respondents (4) have an average of 9 years of schooling (the equivalent to finishing junior high school). The least religious respondents (0) have an average of 11 years of schooling (equivalent to finishing senior high school). The outcome indicates that the negative relationship between religiosity and garbage scores is caused by years of schooling. This means that an individual's level of religiosity does not affect involvement in SW disposal activities. This strange phenomenon is caused by the spread of religious people throughout Indonesia with relatively fewer years of schooling (compared to non-religious groups). The table above signals that years of schooling is a more valuable and significant factor than religiosity. Years of education estimates respondents' education levels, as recorded in the IFLS data.

Policy implications

In recent years (due to the difficulty of managing SW compared to organic waste), SWM has become a concern in environmental studies. Countries' increasing economic, population and tourism sectors make SWM a considerable challenge (Meylan *et al*., 2018; Sembiring and Nitivattananon, 2010). There are many choices regarding the most appropriate methods of waste management. Consequently, detailed analysis (including stakeholders' perspectives) is

Table 3: The average garbage score by religiosity and years of schooling

Religiosity level	Mean number of years of schooling	S.D.	Frequency
0	11.1	3.9136079	50
1	9.372035	3.0820313	801
2	10.478024	3.1257586	6.416
3	10.187081	3.5137577	18.190
4	9.1179935	3.4007337	4.924
Total	10.055265	3.4363785	30.381

necessary to achieve sustainable management (Iacovidou and Voulvoulis, 2018). Communities are often uncooperative in implementing government-created waste policies. Multiple factors cause this inflexible attitude. Many residents in Japan are reluctant to pay support fees for SWM. This hesitation arises from the absence of conjoint analysis (CA) when the government forms waste management policies. The Japanese government has not communicated the risks of waste management (a public service) yet to its citizens. Only the private sector provides this kind of communication, and there are substantive reasons why residents must pay waste management fees. If the Japanese government wants residents to be more cooperative in regulating waste management and recycling, CA must be performed. In this sense, the most-preferred public policies also represent citizens' views (Sakata, 2007).

SWM policies in other Asian cities

Urbanization, industrialization, and population have increased in developing Asian countries. These factors all contribute to SW generation. The SW generation in India (with a population is 217 million) is between 0.2 kg/capita/day and 0.5 kg/capita/day (Sharholy *et al*., 2008). Biodegradable organics comprise most SW in cities in developing countries. According to the Environment and Forestry Ministry, as of 2015, the average person in Indonesia produces 0.7 kilograms of waste per day. With 250 million people, the total waste generated each day is 175.000 tons, amounting to 64 million tons per year (Jong, 2015). In developed Asian countries (such as Japan, Singapore, Taiwan, and South Korea), these values are generally less than 45% (Shekdar, 2009). Developing countries in Asia have similar conditions. SW generation is high due to large populations, and its main component is decomposable organics. For example, decomposable organics comprise 61.5% of Malaysia's SW (Manaf *et al*., 2009). In Indonesia, plastic waste amounts to around 25.000 tons per day (Mann, 2009). Common problems include 1) a lack of collection coverage (Sembiring and Nitivattananon, 2010) and 2) open-dumped landfills as the final disposal location. This disposal method causes soil, surface, and groundwater pollution from leachate (Ngoc and Schnitzer, 2009). Further, greenhouse gas (GHG) emissions result from the waste decomposition process (Lou and Nair, 2009). Governments must prioritize SWM in developing countries' major cities. Based on World Bank data, in 2016, a group of certain cities yielded 2.01 x 109 billion tones of solid waste. SWM in urban areas has become an urgent matter due to high population growth and urbanization. SW is created very quickly in urban zones, making assimilation by the natural environment impossible. City governments are overwhelmed with attempts to manage SW. Compared to urban residents in developed countries, those in developing nations (especially poor urban residents) are the most disadvantaged by unsustainable SWM (Clark, 2018). In large cities in most developing states, SWM has become the main problem in urban planning, public management, and industrial management. Unfortunately, stakeholders (such as the government and owners of large industries) have not found adequate solutions to SWM-related social and environmental concerns (Azevedo *et al.,* 2019). Most SW treatment for urban areas is inadequate. During the first decade of the 21st century, humanity used so much plastic that it has largely filled the ocean. According to the Russian Federation's Ministry of Natural Resources and Environmental Protection, humans produce more than 60 million tons of municipal SW annually. However, only about 7-8% of all garbage is collected. In the European Union (EU) nations, things are not as bad as in Indonesia. In 2012, around 50% of plastic was disposed of in the right place (disposal centres); the rest was burned (Bashkirova and Lessovaia, 2019). Large cities in Malaysia also experience obstacles in achieving effective SW management. Municipal waste in Malaysia is handled through traditional disposal methods, which create visual disturbances and stir anxiety among the public due to health and ecological risks. The country's SWM policy requires Malaysians to indirectly pay a waste collection fee through their monthly housing assessments (Moh and Manaf, 2014), but the government has never announced the amount of money allocated for waste collection. Since the amount of waste is increasing in Malaysia's urban areas, many parties expect that SWM service providers will improve the quality of factory waste management, but to properly boost quality, waste collection fees must also be increased (Jamal *et al.,* 2011). Many complex problems arise during the waste collection process (the most important aspect of SWM). For example, in Ethiopian cities, there is a poor waste separation

process and significant illegal dumping. Education levels have positive relationships with communities' environmental concerns. Additionally, the distance between waste disposal centres and residents' homes affects their willingness to collect SW and bring it to waste disposal centres (Bashkirova and Lessovaia, 2019). In China, the number of waste pickers who collect municipal solid waste (MSW) has reached four million people. Unfortunately, the government and society continue to deny their existence. In Nanjing, China, waste pickers informally gather 70-80% of MSP materials (Chen *et al*., 2018). Their collection process is not formally organized by either the government or the private sector. The recycled material accrued by waste pickers is worth approximately 79-85 million USD per year. Nanjing's waste pickers have helped the private sector to save up to 22 million USD annually in the MSW disposal process. Regrettably, waste pickers only receive an average profit of 8%. This is very inappropriate because waste collectors could be more empowered by the government (Jamal *et al.,* 2011). In ideal circumstances, waste collectors would be given better benefits, and SWM in urban areas would be more coordinated. If they were supported by regulations and equitable policies to improve their working and living conditions, more effective (and safer), MSW management could be realized. Marshall and Farahbakhsh (2013) have discussed many failures of MSW policies in developing countries. These problems require governments to trigger public participation in creating effective SWM. In addition to community participation, other factors have hampered urban SWM. As of 2008, urban SWM has had general structural issues, such as ineffective waste collection point operations. There are no signs that inform residents that a certain site is a waste collection point. Often, private projects undertaken by SWM groups or management institutions comprise the main obstacle hindering effective SWM. There is no integration of plans or a holistic view, uniting different waste projects. Overlapping assignments often occur, and areas reachable by officers are distributed unevenly. By 2018, some structural challenges (such as overlapping assignments) were reduced. At the very least, simple problems (such as administration and structure) are no longer major factors in SWM failures. This is an improvement upon the difficulties found in many urban zones (Azevedo *et al*., 2019).

Burdens in applying proper policies

Although garbage has become a significant concern in Jakarta, efforts to overcome it are progressing poorly. As mentioned, many hurdles make community empowerment in managing waste problematic. The following factors lead to more significant garbage heaps; 1) the number of individuals, 2) the capacity of community-produced reserves and 3) communities' higher production and consumption levels. In addition to the general issues of urbanization, cities have taken little initiative towards empowering themselves to avoid complications related to waste. In this context, empowerment is defined as the process of enhancing feelings of self-efficacy among organizational members [by identifying] conditions that foster powerlessness and [removing them through] both formal organizational practises and informal techniques of providing efficacy information. The government does have garbage management policies. For example, Jakarta's Governor Regulation Number 400 of 2016 covers the formation, organization, and working procedures of the integrated waste management unit in the JPEA (2016a), while Governor Regulation Number 284 of 2016 involves organization and work procedures of the Environmental Agency (JPEA, 2016b). Self-efficacy is a person's confidence in his/her ability to make decisions and or actions needed for specific interests. To deal with garbage, for instance, people carry their shopping bags to reduce plastic waste. Unfortunately, data from the Central Statistics Agency in 2017 note that only about 10% of the public carry their shopping bags often. More than 70% of people claimed that they never bring their pockets with them. The rest responded with 'sometimes'. Governments and pertinent institutions need to raise awareness and build insight to achieve a good start (Davis and Elliot, 2014). The reality of the Jakarta community is at odds with the concepts described in the previous theoretical discussion. Data from the National Socio-Economic Survey (SUSENAS), conducted by the Central Statistics Agency in 2017, showed that more than 75% of residents in Jakarta do not process wet or dry waste. The rest (but not all) do sort their waste, as broken down here: 13.19% sometimes sort, 2.62% often sort, and the remaining 6.35% always sort wet and dry rubbish. Those who do not separate damp from bare litter lack knowledge and feel that such work is a waste of time. As a

result, there are no distinct sorting facilities (or sites to dispose of the two kinds of rubbish separately). Without knowledge of proper waste management, some of them handle waste in less than ideal ways. Some landowners often bury or burn it. Of course, burning is not a wise approach, as it will impact global warming and air pollution nearby. A small number use some of the waste as compost. Those who find waste to be of little economic value choose to dispose of it in garbage banks for recycling. Citizens' initiatives to turn waste into fertilizer/compost generally require integrated efforts (Johannes, 2018). In this regard, the government should provide guidance and education as frequently as possible. Of course, only around 9% of respondents were deemed very 'creative' in how they dispose of waste (as opposed to littering, not sorting trash, or scattering debris). Previous research has identified a small portion of residents who litter. They throw waste into rivers, ditches, and even waterways. One possible reason for this behaviour may be that their settlements are close to rivers. As the vanguard, the government seems to have failed at making communities realize the importance of protecting the environment. Resolving substantial waste often creates conflict. The significance of building sustainable ecosystems is contrary to the high level of environmental management utilized for community needs. The uncontrolled production of SW and lack of natural resources are critical factors that slow down the handling of environmental issues. SW poisons arable land, including soil, water, and biota. This dilemma occurs at all levels and across fields. Conflicts often involve stakeholders, non-governmental organizations (NGOs), and the private sector (Marshall and Farahbakhsh, 2013).

CONCLUSION

This study revealed that in Jakarta, individuals' participation in community waste disposal increases based on; 1) the frequency of involvement in community social activities, 2) years of schooling, and 3) PCE. The study demonstrates that the Jakarta Provincial Government has a high propensity toward increasing residents' participation in SWM by maximizing control of the factors mentioned above (primarily through empowerment), as well as towards raising the frequency of citizen involvement in social community activities at the grassroots level. These social activities must also provide benefits that prove interesting to residents. As for long-term solutions, increasing education levels (which will also impact income) must be considered. The study informs that, to date, the DKI Jakarta municipal government has not exhaustively exploited all potential resources to handle SWM in its territory. The municipal government still has the chance to enhance its ability to take care of SWM through socially engineered strategies, namely through the voluntary actions of informal activities/individual citizens, instead of using up the resources of formal/government agencies. Each region/community has different characteristics. If a government aims to make a garbage policy successful, it must consider factors that influence individual participation in targeted areas. In Japan and Malaysia, society is uncooperative because policy transparency is not optimal. Therefore, governments must publish transparent data linking the policy visions to its budget allocation. Waste management conflicts in DKI Jakarta are caused by differences in environmental perspectives between the community at large, stakeholders, and individual community members. Misunderstandings in the communication process may result in, firstly, messages are not being appropriately conveyed between parties. Such false impressions are possible if one party cannot grasp the purpose of the message sent by the interlocutor. Secondly, parties' attitudes may begin to differ. These contrasting views of waste management make it difficult to improve the situation. The sources of the problem are twofold. Firstly, the government has not succeeded in imparting the values of communal care for the environment. Secondly, the community lacks the urge to learn about environmental protection. The government can create a community empowerment program that could effectively influence people's behaviour in processing waste. To make the program beneficial, the government cannot just use a single approach. The program must be adapted to the features of the neighbourhood, especially for areas where most residents are poor. Hence, the planning of such a program must involve the analysis used in anthropology, such that the design is derived from highly contextual research that is modelled on each community's traits. When the program is ready to be implemented, the government must ensure that the chain of command (that monitors the program's operation) is well organized, from the ministry level to that of the neighbourhood. The Ministry of Social

Affairs has various policies that produce community empowerment programs. A new initiative for waste education could involve a collaboration between the Ministry of Social Affairs and the Ministry of Environment. Most of the abovementioned problems could be solved by empowering individuals, as well as by raising the frequency of Jakarta's citizens' involvement in social community activities at the grassroots level.

AUTHOR CONTRIBUTIONS

A. Brotosusilo designed the whole concept of the manuscript and led the study. S.H. Nabila conducted the comprehensive review. H.A. Negoro collected and analyzed the data. D. Utari focused on structuring the paper.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

ABBREVIATIONS

%	percent
ASEAN	Association of Southeast Asian Nations
β_0	constant parameter
β_1 Indv_ Partiscore	parameter for individual score for participation in each social activity held in the respondent's neighborhood
β_2 Empowerment	parameter for number of social activities held in respondent's neighborhood in the last week
$\beta_4 EDUC$	parameter for respondent's education level, measured by their years of schooling
$\beta_5 PCE$	parameter for expenditure per capita, in Rupiah
$\beta_6 Religiosity$	parameter for subjective level of selves' religiosity
$\beta_7 Age$	parameter for respondent's age
$\beta_8 Sex_i$	parameter for dummy variable for respondent's sex, identifying men and women
BPS	National Bureau of Statistics of Indonesia
CA	conjoint analysis
DKI Jakarta	Special Capital District of Jakarta
DKPP	Jakarta's Cleaning, Park and Cemeteries Department
Est	estimation
et al.	*et alia*
etc.	*et cetera*
FDS	Final Disposal Site
Fig.	figure
Garbagescore	score of an individual's participation in garbage-related activities (e.g. neighborhood cleaning, handling solid wastes)
GDP	Gross Domestic Product
GHG	greenhouse gas
GNI	Gross National Index
IFLS	Indonesian Family Life Survey
IRENA	International Renewable Energy Agency
JPEA	Jakarta Provincial Environmental Agency
kg/capita/day	kilograms per person per day
NGOs	Non-Government Organizations'
OLS	ordinary least squares
p	calculated probability value
PCE	per capita expenditure
PDUPT	Higher Education Leading Basic Research
Susenas	National Socio-Economic Survey
SW	solid waste
SWM	solid waste management
Three Rs	reduce-reuse-recycle

REFERENCES

Asim, M.; Batool, S., (2012). Scavengers and their role in recycling of waste in Southwestern Lahore. Resour. Conserv. Recycl., 152-162 **(11 pages)**.

Azevedo, B.D.; Scavarda, L.F.; Caiado, R.G., (2019). Urban solid waste management in developing countries from the sustainable supply chain management perspective: A case study of Brazil's largest slum. J. Cleaner Prod., 1377-1386 **(10 pages)**.

Bashkirova, N.N.; Lessovaia, S.N., (2019). Waste Management as Sunctional Part of the Social Responsibilities of Business. International science and technology conference "Earth science", 272 **(10 pages)**.

Burcea, S.G., (2015). The Economical, Social and Environmental Implications of Informal Waste Collection and Recycling. Theor. Empirical Res. Urban Manage., 14-24 **(11 pages)**.

Chen, F.; Luo, Z.; Yang, Y.; Liu, G.-J.; Ma, J., (2018). Enhancing municipal solid waste recycling through reorganizing waste pickers: A case study in Nanjing, China. Waste Manage. Res., 1-12 **(12 pages)**.

Clark, J.R., (2018). Coastal zone management handbook. CRC Press.

Davis, J.; Elliott, S., (2014). Research in early childhood education for sustainability: International perspectives and provocations. Routledge.

Dhokhikah, Y.; Trihadiningrum, Y., (2012). Solid waste management in Asian developing countries: challenges and opportunities. J. Appl. Environ. Biol. Sci., 2(7): 329-335 **(7 pages).**

Ezeah, C.; Fazakerley, J.; Roberts, C., (2013). Emerging Trends in Informal Sector Recycling in Developing and Transition Countries. Waste Manage., 2509-2519 **(11 pages)**.

Ferronato, N.; Torretta, V., (2019). Waste Mismanagement in Developing Countries: A Review of Global Issues. Int. J. Environ. Res. Public Health. 1060.

Gunsilius, E.; Chaturvedi, B., (2011). The Economics of the Informal Sector in Solid Waste Management. Solid Waste Manage., 50-59 **(10 pages)**.

Halimatussadiah, A.; Muhammad, F.; Indraswari, K.D., (2017). What drive students to behave more environmentally friendly towards waste?. A. J. Community Engagement, 41-58 **(18 pages)**.

Iacovidou, E.; Voulvoulis, N., (2018). A multi-criteria sustainability assessment framework: development and application in comparing two food waste management options using a UK region as a case study. Sustainable Waste Manage., 25: 35821-35834 **(14 pages)**.

IEA, (2015). Indonesia joined IEA Association in 2015. International Energy Agency.

IRENA, (2017). Renewable energy prospect: Indonesia, a Remap analysis. International Renewable Energy Agency (IRENA).

JPEA, (2016a). Jakarta Governor Regulation Number 400 of 2016 concerning the Formation, Organization and Working Procedure of the Integrated Waste Management Unit. Jakarta Provincial Environmental Agency.

JPEA, (2016b). Governor Regulation Number 284 of 2016 concerning Organization and Work Procedures of the Environmental Agency. Jakarta Provincial Environmental Agency.

Jerie, S.; Tevera, D., (2014). Solid Waste Management Practices in the Informal Sector of Gweru, Zimbabwe. J. Waste Manage., Article ID 148248, 1-7 **(7 pages).**

Johannes, H.P. (2018). Waste reduction through integrated waste management modeling at Mustika Residence (Tangerang). J. of Environ. Sci. Sustainable Develop., 1(1): 12-24 **(13 pages).**

Jong, H.N., (2015). Indonesia in state of waste emergency.

Joshi, R.; Ahmed, S., (2016). Status and challenges of municipal solid waste management in India: A review. Cogent Environ. Sci., 1139434 **(18 pages).**

Khalil, M.; Berawi, M.A.; Heryanto, R.; Rizalie, A., (2019). Waste to energy technology: The potential of sustainable biogas production from animal waste in Indonesia. Renewable Sustainable Energy Rev., 105: 323-331 **(9 pages)**.

Kumar, S.; Smith, S.R.; Fowler, G.; Velis, C.; Kumar, S.J.; Arya, S.; Cheeseman, C., (2017). Challenges and opportunities associated with waste management in India. R. Soc. Open Sci., 160764 **(11 pages).**

Holmberg, C.; Larsson, C.; Korp, P.; Lindgren, E.C.; Jonsson, L.; Fröberg, A.; Chaplin, J.E.; Berg, C., (2018). Empowering aspects for healthy food and physical activity habits: adolescents' experiences of a school-based intervention in a disadvantaged urban community. Int. J. Qual. Stud. Health Well-being. 1487759 **(14 pages).**

Hynes, S.; Tinch, D.; Hanley, N., (2013). Valuing improvements to coastal waters using choice experiments: An application to revisions of the EU Bathing Waters Directive. Mar. Policy, 137-144 **(8 pages).**

Jamal, O.; Jeff, B.; Russell, B., (2011). Environmental values and resource management options: A choice modelling experience in Malaysia. J. Environ. Manage., 2993-3001 **(9 pages).**

Lestari, P.; Trihadiningrum, Y., (2019). The impact of improper solid waste management to plastic pollution in T Indonesian coast and marine environment. Mar. Pollut. Bull., 149 **(10 pages)**.

Lou, X.F.; Nair, J., (2009). The impact of landfilling and composting on greenhouse gas emissions – A review. Bioresour. Technol., 100: 3792-3798 **(7 pages)**.

Manaf, L.A.; Samah, M.A.A.; Zukki, N.I.M., (2009). Municipal solid waste management in Malaysia: Pratices and challenges. Waste Manage., 29: 2902-2906 **(5 pages)**.

Mann, A., (2009). The waste challenge: Is Indonesia at a tipping point?

Marshall, R.E.; Farahbakhsh, K., (2013). Systems approaches to integrated solid waste management in developing countries. Waste Manage., 33(4) **(10 pages)**.

Marchal, V.; Dellink, R.; Van Vuuren, D.; Clapp, C.; Chateau, J.; Magné, B.; Van Vliet, J., (2011). OECD Environmental Outlook to 2050.

lister, J., (2015). Factors influencing solid-waste management in the developing World.

Meylan, G.; Lai, A.; Hensley, J.; Stauffacher, M.; Krülti, P., (2018). Solid waste management of small island developing states—the case of the Seychelles: a systemic and collaborative study of Swiss and Seychellois students to support policy. Environ. Sci. Pollut. Res., 25(36): 35791-35804 **(14 pages)**.

Moh, Y.C.; Manaf, L.A., (2014). Overview of household solid waste recycling policy status and challenges in Malaysia. Resour. Conserv. Recycl., 50-61 **(12 pages).**

Ni'mah, N.L.K.; Herdiansyah, H.; Soesilo, T.E.B.; Mutia, E.F., (2018.) Strategy for increasing the participation of masyarakat peduli api in forest fire control. IOP Conference Series. Earth Environ. Sci., 126 **(10 pages).**

Tharakan, P., (2015). Summary of Indonesia's Energy Sector

Assessment. Manila: ADB.
Ruliana, V.; Soemantojo, R.W.; Asteria, D., (2019). Assessing a community-based waste separation program through examination of correlations between participation, information exposure, environmental knowledge, and environmental attitude. ASEAN J. Community Engagement, 3(1): 1-24 **(24 pages).**
Sembiring, E.; Nitivattananon V., (2010). Sustainable Solid Waste Management Towards and Inclusive Society: Integration of the Informal Sector. Resour. Conserv. Recycl., 802-809 **(8 pages)**.
Shekdar, A.V., (2009). Sustainable solid waste management: an integrated approach for Asian countries. Waste Manage., 1438-1448 **(11 pages).**
Shuker, I.G.; Cadman, C.A., (2018). Indonesia - Marine debris hotspot rapid assessment: synthesis report.
Sinthumule, N.I.; Mkumbuzi, S.H., (2019). Participation in community-based solid waste management in Nkulumane suburb, Bulawayo, Zimbabwe. Resources, 30 **(16 pages).**
Stingl, S., (2018). Resilience of urban systems in the face of natural hazards: To what extent do humanitarian organizations contribute to flood preparedness in Jakarta?
Strauss, J.; Witoelar, F.; Sikoki, B., (2016). The fifth wave of the Indonesia family life survey: Overview and Field Report. RAND.
White, M.A., (2013). Sustainability: I know it when I see it. Ecol. Econ., 213-217 **(5 pages).**
Yoada, R.M.; Chirawurah, D.; Adongo, P.B., (2014). Domestic waste disposal practice and perceptions of private sector waste management in urban Accra. BMC Public Health, 697 **(10 pages).**
Zakianis, Z.; Koesoemawardani, P.; Fauzia S.; Asror, M.M.; Ferliana, E., (2018). The citizens' participation of household solid waste management and monitoring of household solid waste separation in Kelurahan Abadijaya, Kecamatan Sukmaja, Depok. ASEAN J. Community Engagement, 2(2): 221-238 **(18 pages).**

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